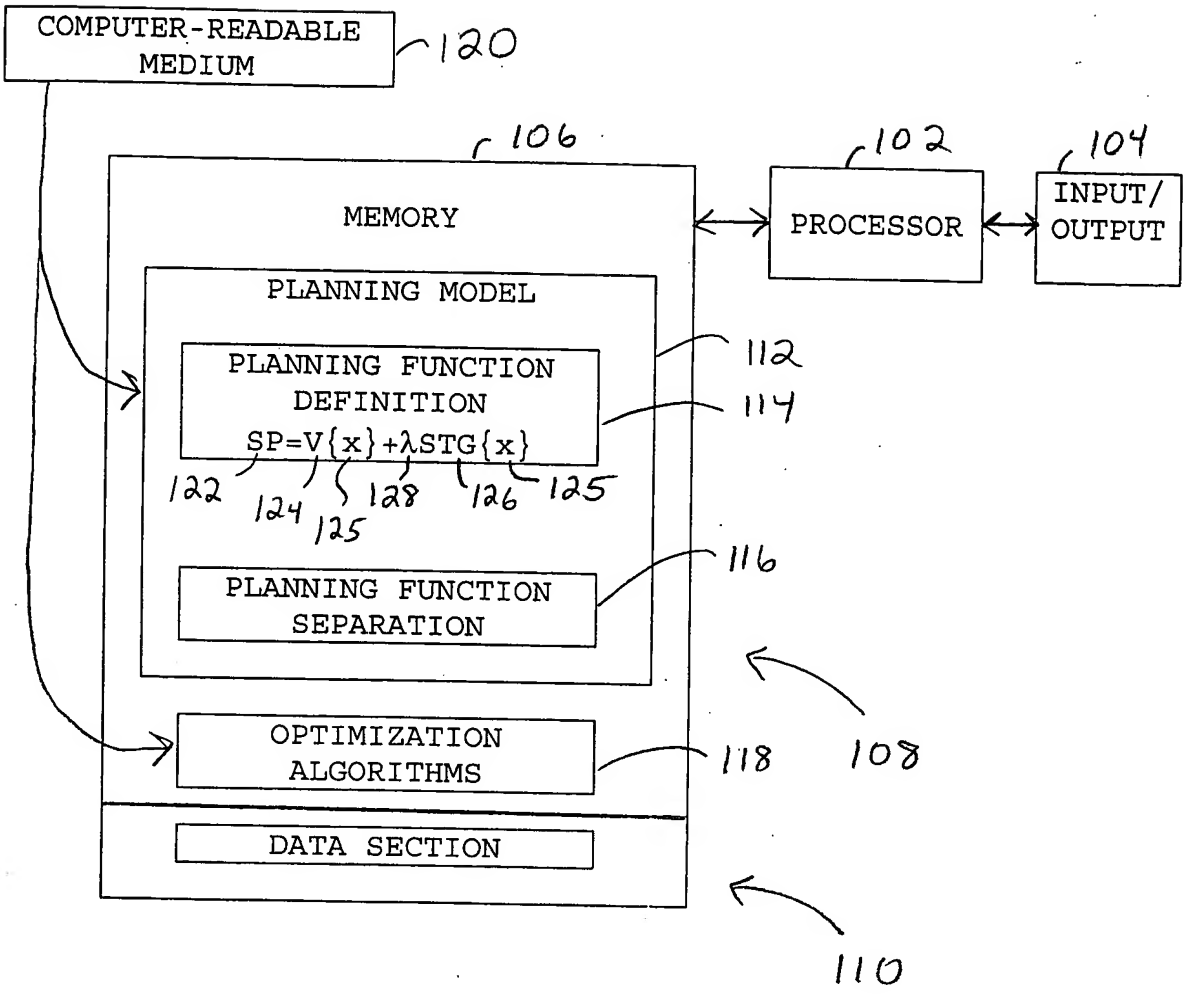

COMPUTER-READABLE MEDIUM
120
106
MEMORY
PLANNING MODEL
PLANNING FUNCTION DEFINITION
SP=V{x}+λSTG{x}
122
124
125
128
126
125
112
114
PLANNING FUNCTION SEPARATION
116
OPTIMIZATION ALGORITHMS
118
108
DATA SECTION
110
102
PROCESSOR
104
INPUT/ OUTPUT

100

FIG. 1

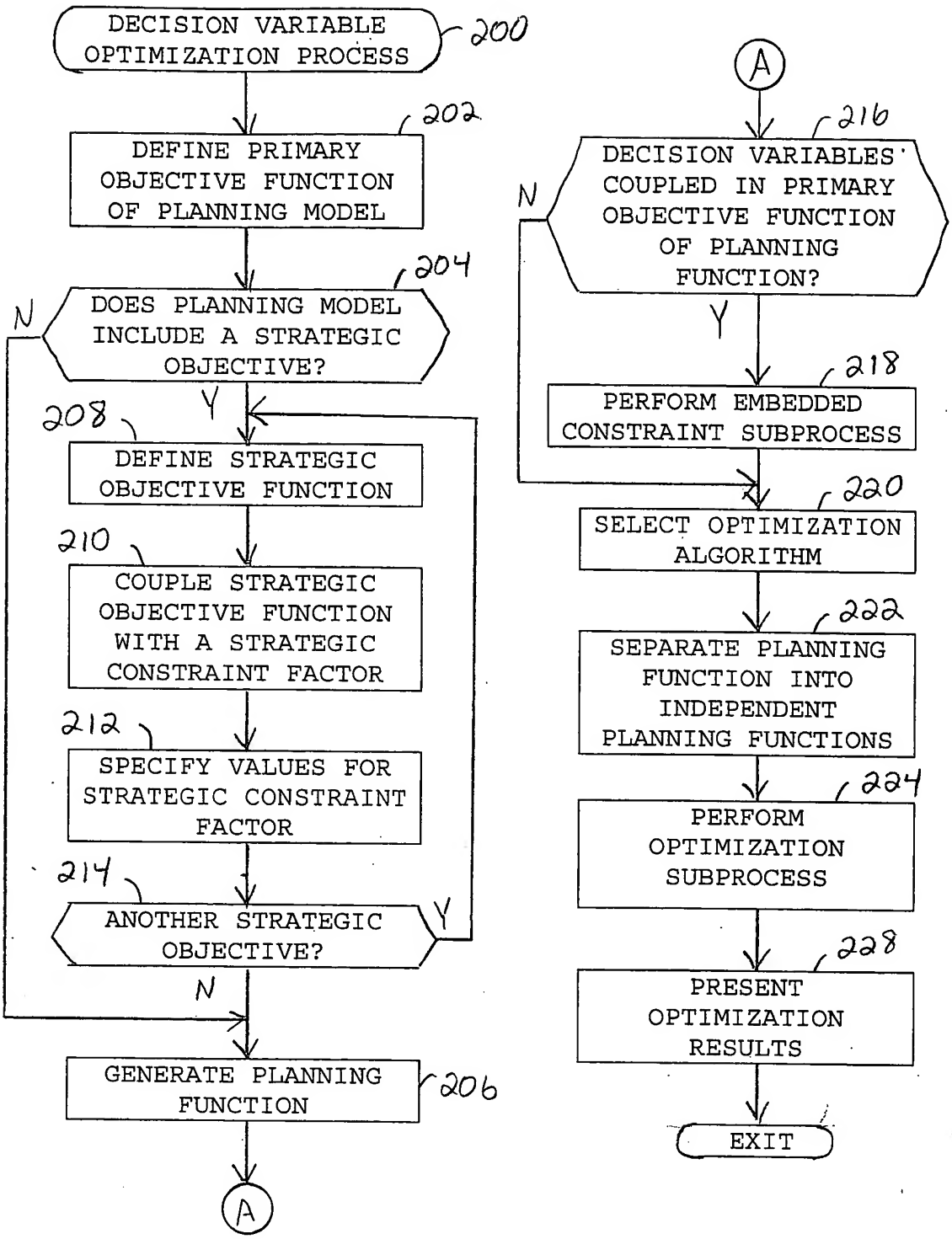

DECISION VARIABLE OPTIMIZATION PROCESS
200
DEFINE PRIMARY OBJECTIVE FUNCTION OF PLANNING MODEL
202
DOES PLANNING MODEL INCLUDE A STRATEGIC OBJECTIVE?
204
N
Y
DEFINE STRATEGIC OBJECTIVE FUNCTION
208
COUPLE STRATEGIC OBJECTIVE FUNCTION WITH A STRATEGIC CONSTRAINT FACTOR
210
SPECIFY VALUES FOR STRATEGIC CONSTRAINT FACTOR
212
ANOTHER STRATEGIC OBJECTIVE?
214
Y
N
GENERATE PLANNING FUNCTION
206
A
A
DECISION VARIABLES COUPLED IN PRIMARY OBJECTIVE FUNCTION OF PLANNING FUNCTION?
216
N
Y
PERFORM EMBEDDED CONSTRAINT SUBPROCESS
218
SELECT OPTIMIZATION ALGORITHM
220
SEPARATE PLANNING FUNCTION INTO INDEPENDENT PLANNING FUNCTIONS
222
PERFORM OPTIMIZATION SUBPROCESS
224
PRESENT OPTIMIZATION RESULTS
228
EXIT

FIG. 2

302	128	128
STRATEGIC CONSTRAINT SCENARIO IDENTIFIER	FIRST STRATEGIC CONSTRAINT FACTOR VALUE λ_1	SECOND STRATEGIC CONSTRAINT FACTOR VALUE λ_2
A	0	0
B	0	0.25
C	0	0.5
D	0	0.75
E	0	1
F	0.2	0
G	0.2	0.25
H	0.2	0.5
I	0.2	0.75
J	0.2	1
K	0.4	0
L	0.4	0.25
M	0.4	0.5
N	0.4	0.75
O	0.4	1
P	0.6	0
Q	0.6	0.25
R	0.6	0.5
S	0.6	0.75
T	0.6	1

302'

304 306 308

300

FIG. 3

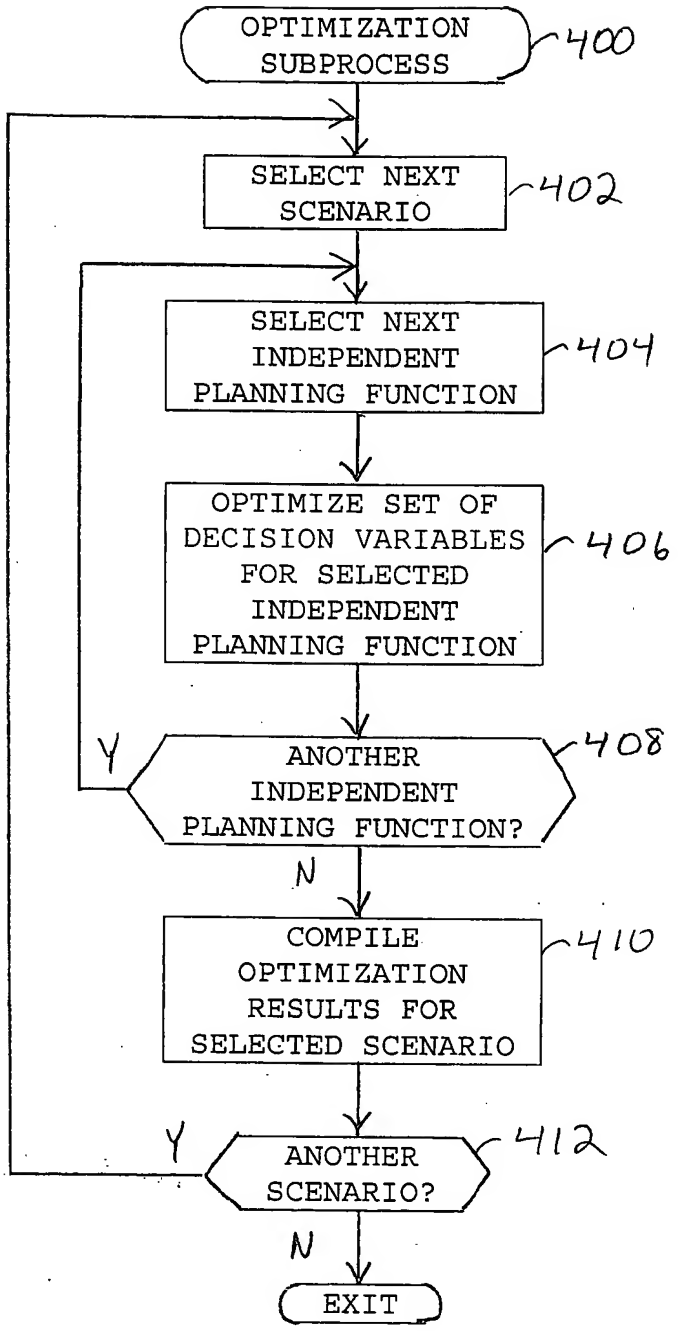

OPTIMIZATION SUBPROCESS
400
SELECT NEXT SCENARIO
402
SELECT NEXT INDEPENDENT PLANNING FUNCTION
404
OPTIMIZE SET OF DECISION VARIABLES FOR SELECTED INDEPENDENT PLANNING FUNCTION
406
Y
ANOTHER INDEPENDENT PLANNING FUNCTION?
408
N
COMPILE OPTIMIZATION RESULTS FOR SELECTED SCENARIO
410
Y
ANOTHER SCENARIO?
412
N
EXIT

FIG. 4

FIG. 5

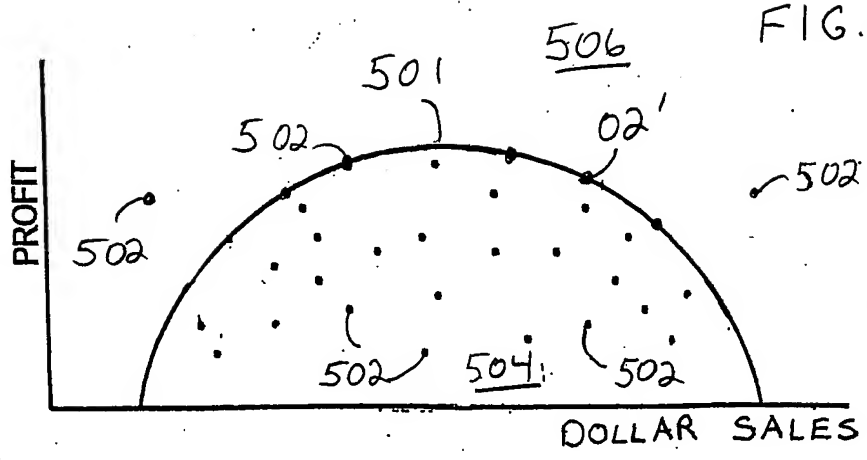


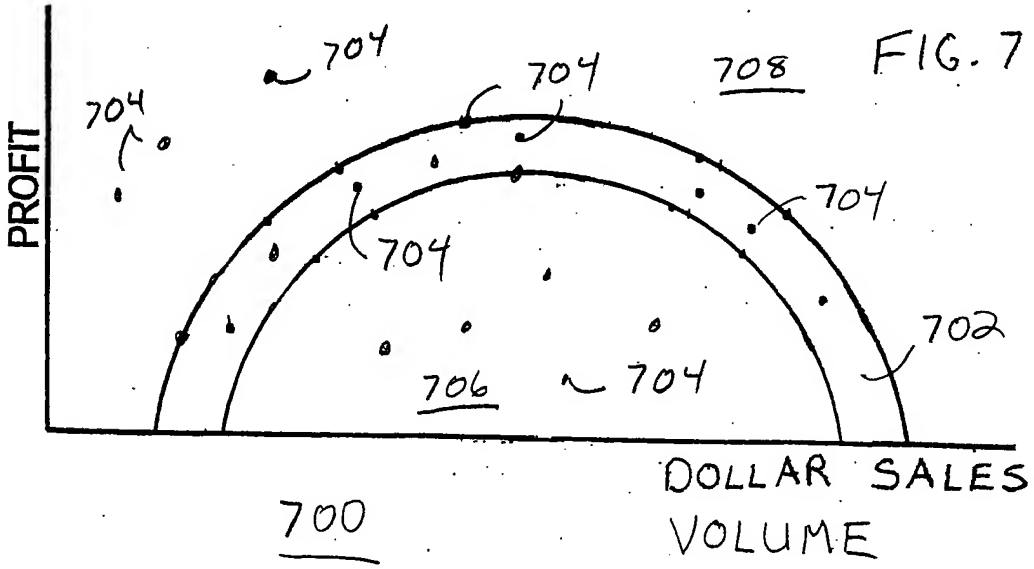
FIG. 6

502' 604 125

PRICING SCENARIO		
ITEM, i, IDENTIFIER	PRICE	NON-PRICE PARAMETERS
1	---	---
2	---	---
3	---	---
4	---	---
.	.	.
.	.	.
.	.	.
N	---	---

606 602 608 600

FIG. 7



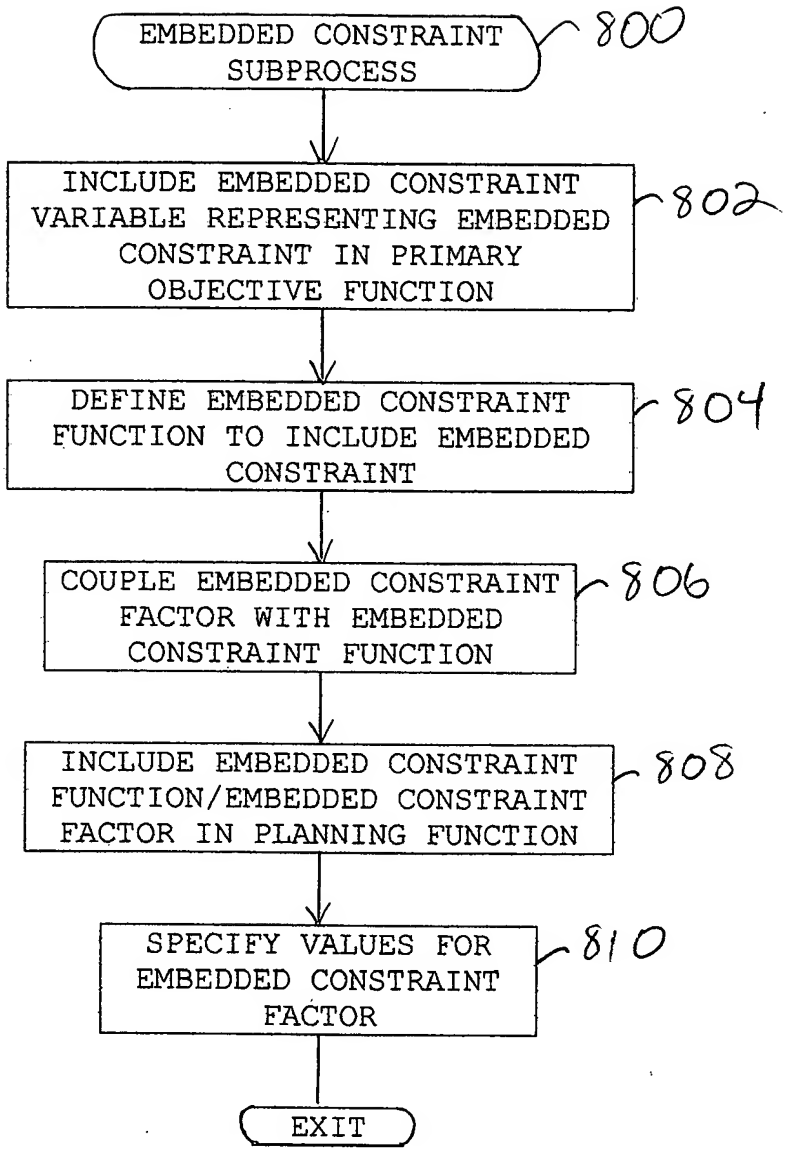

EMBEDDED CONSTRAINT SUBPROCESS
800
INCLUDE EMBEDDED CONSTRAINT VARIABLE REPRESENTING EMBEDDED CONSTRAINT IN PRIMARY OBJECTIVE FUNCTION
802
DEFINE EMBEDDED CONSTRAINT FUNCTION TO INCLUDE EMBEDDED CONSTRAINT
804
COUPLE EMBEDDED CONSTRAINT FACTOR WITH EMBEDDED CONSTRAINT FUNCTION
806
INCLUDE EMBEDDED CONSTRAINT FUNCTION/EMBEDDED CONSTRAINT FACTOR IN PLANNING FUNCTION
808
SPECIFY VALUES FOR EMBEDDED CONSTRAINT FACTOR
810
EXIT

FIG. 8

EMBEDDED CONSTRAINT SCENARIO IDENTIFIER (904)	EMBEDDED CONSTRAINT FACTOR VALUE γ (903)
AA	0
BB	0.15
CC	0.25
DD	0.35
EE	0.45
FF	0.55
GG	0.65
HH	0.75
II	0.8
JJ	0.85
KK	1
LL	1.25
MM	1.35
NN	1.45
OO	1.55
PP	1.65

906 902

900

FIG. 9

1002

EXAMPLE 1	
PRIMARY OBJECTIVE	GROSS PROFIT
STRATEGIC OBJECTIVE	DOLLAR SALES
DECISION VARIABLES	PRICES OF ITEMS, p_i
TACTICAL CONSTRAINTS	NONE
PRIMARY OBJECTIVE FUNCTION	$V(\{p\}) = \sum_i US_i(p_i - c_i)$ WHERE $US_i = \exp(q_i^o - \beta_i p_i)$,
STRATEGIC OBJECTIVE FUNCTION	$STG(\{p\}) = \sum_i p_i US_i$
PLANNING FUNCTION	$SP(\{p\}) = \sum_i US_i(p_i - c_i) + \lambda \sum_i p_i US_i$
OPTIMIZATION ALGORITHM	CLOSED FORM ANALYTICAL ALGORITM
INDEPENDENT PLANNING FUNCTION	$SP_i(p_i) = US_i(p_i - c_i) + \lambda p_i US_i$ WHICH YIELDS THE FOLLOWING OPTIMIZATION EQUATION: $p_i^* = c_i + \frac{1}{\beta_i} - \frac{\lambda}{1+\lambda} \cdot c_i$

1004 1006 1008 1010 1012 1014 1016 1018 1020 1022

1000

FIG. 10

1102

EXAMPLE 2	
PRIMARY OBJECTIVE	GROSS PROFIT
STRATEGIC OBJECTIVE	DOLLAR SALES
DECISION VARIABLES	PRICES OF ITEMS, p_i
TACTICAL CONSTRAINTS	NONE
PRIMARY OBJECTIVE FUNCTION	$V(\{p\}) = \sum_i US_i h(p_i)$
STRATEGIC OBJECTIVE FUNCTION	$STG(\{p\}) = \sum_i p_i US_i$
PLANNING FUNCTION	$SP(\{p\}) = \sum_i US_i h(p) + \lambda \sum_i p_i US_i$
OPTIMIZATION ALGORITHM	ONE-DIMENSIONAL OPTIMIZATION ALGORITM
INDEPENDENT PLANNING FUNCTION	$SP_i(p_i) = US_i h(p_i) + \lambda p_i US_i$ WHICH YIELDS THE FOLLOWING OPTIMIZATION EQUATION: $SP_i(p_i^*) = \max_{p_i} SP_i(p_i)$

1104 1106 1108 1110 1112 1114 1116 1118 1120 1122

1100

FIG. 11

1202

EXAMPLE 3	
PRIMARY OBJECTIVE	NET PROFIT
STRATEGIC OBJECTIVE	DOLLAR SALES
DECISION VARIABLES	PRICES OF ITEMS, p_i
TACTICAL CONSTRAINTS	$p_i^{min} \leq p_i \leq p_i^{max}$
PRIMARY OBJECTIVE FUNCTION	$V(\{p\}) = \sum_i (US_i h(p_i) - AC_i(1-\delta(x)))$ WHERE $x = p_i - p_i^c$
STRATEGIC OBJECTIVE FUNCTION	$STG(\{p\}) = \sum_i p_i US_i$
PLANNING FUNCTION	$SP(\{p\}) = \sum_i (US_i h(p_i) - AC_i(1-\delta(x))) + \lambda \sum_i p_i US_i$
OPTIMIZATION ALGORITHM	ONE-DIMENSIONAL OPTIMIZATION ALGORITM
INDEPENDENT PLANNING FUNCTION	$SP_i(\{p_i\}) = US_i h(p_i) - AC_i(1-\delta(x)) + \lambda p_i US_i$ WHICH YIELDS THE FOLLOWING OPTIMIZATION EQUATION: $SP_i(p_i^*) = \max_{p_i} SP_i(p_i)$

1204 1206 1208 1209 1210 1212 1214 1216 1218 1220 1222

1200

FIG. 12

1302

EXAMPLE 4	
PRIMARY OBJECTIVE	GROSS PROFIT 1304
STRATEGIC OBJECTIVE	NONE
DECISION VARIABLES	PRICES OF ITEMS, p_i 1308
TACTICAL CONSTRAINTS	NONE
PRIMARY OBJECTIVE FUNCTION	$V(\{p\}) = \sum_i US_i(p_i - c_i)$, 1310 WHERE $US_i = Dms_i$ $ms_i = \frac{g_i}{\sum_k g_k}$
EMBEDDED CONSTRAINT FUNCTION	$EMB(\{p\}) = \frac{\sum_i g_i}{Z} - 1$ 1312 ALLOWS A BREAK IN THE COUPLING IN THE MARKET SHARE MODEL BY SETTING $ms_i = \frac{g_i}{Z}$ WHICH IS EQUIVALENT TO THE MARKET SHARE MODEL WHEN $\sum_k g_k = Z$ OR EMB=0
STRATEGIC OBJECTIVE FUNCTION	NONE
PLANNING FUNCTION	$SP(\{p\}) = \sum_i US_i(p_i - c_i) - \gamma\left(\frac{\sum_i g_i}{Z} - 1\right)$ 1316 1318
OPTIMIZATION ALGORITHM	ONE-DIMENSIONAL OPTIMIZATION ALGORITM 1320
INDEPENDENT PLANNING FUNCTION	$SP_i(p_i) = Dg_i(p_i - c_i) - \gamma(g_i)$ 1322 WHICH YIELDS THE FOLLOWING OPTIMIZATION EQUATION: $SP_i(p_i^*) = \max_{p_i} SP_i(p_i)$ 1324

1300

FIG. 13